NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

FORAGE HARVEST MANAGEMENT

(Acre)

CODE 511

DEFINITION

The timely cutting and removal of forages from the field as hay, green-chop, or ensilage.

PURPOSES

- Optimize the economic yield of forage at the desired quality and quantity
- Promote vigorous plant regrowth
- Maintain stand life for the desired time period
- Maintain desired species composition of the stand
- Use forage plant biomass as a nutrient uptake tool
- Control insects, diseases and weeds
- Maintain and/or improve wildlife habitat

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to all land uses where machine harvested forage crops are grown.

CRITERIA

General criteria applicable to all purposes

Forage will be harvested at a frequency and height that will maintain a desired healthy plant community through its life expectancy.

Stage of Maturity. Harvest forage at the stage of maturity that provides the desired quality and quantity.

Delay harvest if prolonged or heavy precipitation is forecast that would seriously damage cut forage.

Where weather conditions make it difficult to harvest the desired quality of forage, use mechanical or chemical conditioners and/or ensile.

Moisture Content. Harvest silage/haylage crops at the ideal moisture range for the type of storage structure(s) being utilized.
Treat direct cut hay crop silage (moisture content > 70%) with chemical preservatives or add dry feed stuffs to avoid fermentation and excess seepage which results in dry matter losses.

For optimal forage quality, rake, ted, or invert swaths, and bale when hay has sufficient moisture to prevent leaf loss.

Bale at optimum moisture levels to preserve forage quality and quantity. Approximate percent moisture should be as follows:

- Bale field cured hay at 15 to 20 percent moisture.
- Bale forced air-dried hay at 20 to 35 percent moisture.
- Rake hay at 30 to 40 percent moisture.
- Ted or invert swaths when moisture is above 40 percent.

Length of cut. When harvested for ensilage forage will be chopped to a size that allows adequate packing to produce the anaerobic conditions necessary to ensure the proper ensiling process.

Contaminants. Forage shall not contain contaminants at levels injurious to the health of the livestock class and type being fed.

Contaminants are any objectionable matter or toxin that can cause illness, death, or rejection of the offered forage.

Additional criteria to improve or maintain stand life, plant vigor, and forage species mix

Stage of Maturity and Harvest Interval. Cut forage plants at a stage of maturity or harvest interval range that will provide adequate food reserves and/or basal or auxiliary tillers or buds for regrowth and/or reproduction to occur without loss of plant vigor.

Cut reseeding annuals at a stage of maturity and frequency that ensures the production of viable seed or ample carryover of hard seed to maintain desired stand density.

If plants show signs of short-term environmental stress, management will be applied in a manner that ensures continued health and vigor of stand.

Stubble Height. Cut forage plants at a height that will promote the vigor and health of the desired species. Cutting heights will provide adequate residual leaf area; adequate numbers of terminal, basal, or auxiliary tillers or buds; insulation from extreme heat or cold; and/or unsevered stem bases that store food reserves needed for full, vigorous recovery.

Manipulate timing and cutting heights of harvest to ensure germination and establishment of reseeding or seeded annuals.

Additional criteria to use as a nutrient uptake tool

Employ a harvest regime that utilizes the maximum amount of available or targeted nutrients.

Additional criteria to control disease, insect, and weed infestations

If a foliar disease, insects, or weeds threaten stand survival or production objective, schedule harvest periods as needed to control disease, insect, and weed infestations.

Lessen incidence of disease, insect damage, and weed infestation by managing for desirable plant vigor.

Additional criteria to improve wildlife habitat values

Maintain appropriate harvest schedule(s), cover patterns, and plant height to provide suitable habitat for the desired specie(s).

CONSIDERATIONS

When pastures produce forage in excess of livestock demand during high growth rate periods, consider preserving forage quality by machine harvesting a portion of the standing crop. Coordinate this practice with the standard Prescribed Grazing (528).

Well-fertilized plants withstand more intense harvest schedules and may produce a higher quantity and quality of forage. Coordinate this practice with the standard Nutrient Management (590).

Select cultivars that are suitable for the harvest regime, species mix, and forage quality desired. For specific nutrient uptake, select species that can maximize uptake. See Pasture and Hay Planting (512) standard.

When insect and disease outbreaks exceed economic thresholds and are uncontrollable by harvest management pesticide applications may be needed. Another option is to select a resistant cultivar when the stand is replaced. See Pest Management (595) standard.

To control forage plant diseases, insects, and weeds, clean harvesting equipment after harvest and before storing. Do not cut forages until dew, rain, or irrigation water on leaves has evaporated.

When weed infestation exceeds the economic threshold and is uncontrollable by forage harvest management alone, weed management should be planned and applied. Refer to Pest Management (595)

Take care not to produce stored forages whose quality is not that needed for optimum performance of the animal being fed. For instance, immature legume forages can be too low in fiber and lead to metabolic disorders in ruminants and an economic loss to the producer due to lowered animal performance.

Direct cut grass and legume silage can create silage leachate (seepage). Consider the collection, storage, and disposal of this leachate as part of an agricultural waste management system.

NRCS, OK
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In conjunction with harvest options, explore storage and feeding options that will retain acceptable forage quality and minimize digestible dry matter loss.

In regions where rainfall and/or humidity levels cause unacceptable forage quality losses in at least one harvest during the year, consider ensiling the forage to reduce or eliminate field-drying time. Other options are, the use of desiccants, preservatives, conditioners, macerating implements, or barn-curing techniques to reduce field drying time, greenchopping, or grazing. These techniques can improve the timeliness of harvest and preserve forage quality.

To reduce safety hazard, avoid operating harvesting and hauling equipment on field slopes over 25 percent, particularly on cross slope traffic patterns.

PLANS AND SPECIFICATIONS

Place the detailed specifications in a site-specific job or design sheet or in the practice narrative in the conservation plan.

These plans and specifications shall be consistent with this standard and shall describe the requirement for applying the practice to achieve its intended purpose.

OPERATION AND MAINTENANCE

Before forage harvest, clear fields of debris that could damage machinery, or if ingested by livestock, lead to sickness (for example, hardware disease) or death.

Monitor weather conditions and take action accordingly before and after cutting to optimize forage wilting or curing time to preserve feed quality and prevent forage swaths or windrows from smothering underlying plants.

Inspect and repair harvesting equipment following manufacturer's preventative maintenance procedures.

All shields shall be in place during machine operation to prevent injury or death. Shut off machinery before working on or unplugging moving parts.

Select equipment sizes and capacities that will in a timely and economically feasible manner handle the acreage normally harvested.

Operate all forage harvesting equipment at the optimum settings and speeds to minimize loss of leaves.

Set shear-plate on forage chopper to the proper theoretical cut for the crop being harvested. Keep knives well sharpened. Do not use recutters or screens unless forage moisture levels fall below recommended levels for optimum chopping action.

Regardless of silage/haylage storage method, ensure good compaction and an airtight seal to exclude oxygen and mold formation.

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REVIEWERS:

Oklahoma State University, Department of Plant and Soil Science.
Technical Committees NRCS Oklahoma

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NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE GENERAL SPECIFICATION

FORAGE HARVEST MANAGEMENT

(Acre)

CODE 511

GENERAL SPECIFICATIONS

Refer to National Range and Pasture Handbook, 600.0506 Managing Forage Cropland, 5.2-49 to 58 for additional guidance.

CRITERIA APPLICABLE TO ALL PURPOSES

Moisture content

Refer To Table 2, Moisture Content For Silage/Haylage Crops

Additional Criteria to Improve or Maintain Stand Life, Plant Vigor, And Forage Species Mix

Refer to Table 1 for optimum cutting times, harvest intervals and cutting heights.

Additional Criteria to Use as A Nutrient Uptake Tool

Refer to Agricultural Waste Management Field Handbook, Section 651.0606, Nutrient Removal by Harvesting of Crops.

Additional criteria to improve wildlife habitat values

Refer to appropriate Wildlife Habitat Appraisal Guides for species of concern. Harvest operations that begin in the center of the field and work toward the outside will flush wildlife species outward.

CONSIDERATIONS

Harvesting early will improve quality but may reduce stand life if done continually. Harvesting later lowers quality but increases yield. Too frequent harvesting tends to decrease overall yield, reduce plant vigor and leads to a progressive stand decline.

On native hay meadows harvesting too late, too short, and/or too often can result in slow stand decline with a corresponding increase of plants such as broomsedge bluestem.

Coordinate pesticide applications with harvest schedules to allow no adverse effects to livestock from herbicide residue in sprayed forages being fed. Follow all labels for harvest or grazing restrictions.

Adequate amounts of lime, nitrogen, phosphate, potash and certain minor elements are needed for yield, quality, and to maintain stand life. Harvested forage removes large amounts of nutrients per acre. A soil test should be used as a guide in determining the amount of fertilizer and lime needed for sustainable hay production. Care should be taken to insure nutrients are returned back on these lands in nearly the same proportion and amount as were removed.

This concept also applies to native hay meadows as they experience a net loss of nutrients. Prescribed burning is a tool that may be used in native hay meadows to maintain the stand. Dormant season grazing will restore a portion of the natural nutrient cycling. Refer to standards for Prescribed Burning (338) and Prescribed Grazing (528A).

Well-fertilized plants withstand more intense harvest schedules and may produce a higher quantity and quality of forage. Coordinate this practice with Nutrient Management (590) standard.

Avoid conducting harvesting operations when the soil is wet to reduce soil compaction and rutting. Also avoid following in the same wheel tracks so that soil compaction can be minimized.

NRCS, OK
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TABLE 1. Table of forage harvest requirements for plant species.

SPECIES	HARVEST PERIOD	MINIMUM CUTTING HEIGHT (inches)	OPTIMUM CUTTING TIMES OR HARVEST INTERVAL 1/ 2/ 3/
GRASSES			
bahiagrass	all cuttings	3	boot to early bloom, 20 - 28 day intervals, 12" regrowth
bermudagrass	all cuttings	3	boot to early heading, thereafter, 18 - 24 days
big bluestem	cut prior to July 10	6	boot to early heading
crabgrass	all cuttings	2	boot to early head
dallisgrass	first cutting	3	pre-boot
eastern gamagrass	all cuttings	8	6 weeks, early boot
fescue	first cutting	4	Early boot stage, then 4 - 6 week intervals. **4/**
Indiangrass	cut prior to July 10	6	boot to pre-heading
Johnsongrass	all cuttings	6	pre-boot to boot, then 21 - 30 day intervals
native hay meadow	one cutting prior to July 10	4 - 6	boot to pre-heading on key plants
old world bluestems	all cuttings	4	boot to early heading, then 25 - 35 day intervals.
orchardgrass	first cutting	3	boot to early heading, then 4 - 6 weeks. **4/**
ryegrass, perennial, annual	all cuttings	4	boot to soft dough, then 25 - 30 days. **4/**
small grains	only cutting	4	milk to soft dough stage
smooth bromegrass	first cutting second and successive cuttings	4 4	(50% head emergence) When new basal sprouts appear at soil surface. (Sterile heads will be 15 to 20" up the stems). **4/**
Sudangrass, millet	all cuttings	6	At pre-boot stage, about 30 - 40 inches tall
switchgrass	cut prior to June 15	6	early boot
weeping lovegrass	first cutting	4	Pre - Boot to early heading, thereafter, 21 - 35 days **4/**

SPECIES	HARVEST PERIOD	MINIMUM CUTTING HEIGHT (inches)	OPTIMUM CUTTING TIMES OR HARVEST INTERVAL 1/ 2/ 3/
LEGUMES			
alfalfa	all cuttings	4	1/10 to 1/4 bloom
	last cutting	4	6 weeks before first killing frost
arrowleaf clover	first cutting	3	early to 1/4 bloom, if with companion grass, cut at correct stage for the grass
berseem clover	first cutting	3	early to 1/4 bloom, if with companion grass, cut at correct stage for the grass
birdsfoot trefoil	all cuttings	3	early to 1/4 bloom, if with companion grass, cut at correct stage for the grass
'Cicer' milkvetch	all cuttings	3	1/10 - 1/4 bloom
cowpeas	first cutting	3	early to mid-bloom
crimson clover	first cutting	3	early to 1/4 bloom, if with companion grass, cut at correct stage for the grass
hairy vetch	first cutting	3	early bloom
'Ladino' clover	first cutting	3	early to 1/4 bloom, if with companion grass, cut at correct stage for the grass
Lespedeza (common, 'Kobe' 'Korean')	first cutting	3	pre-bloom to early bloom
Lespedeza, sericea	first cutting	3	Cut before plant reaches 12" height
red clover	first cutting	3	early to 1/4 bloom, if with companion grass, cut at correct stage for the grass
Sweetclover	first cutting	3	when first blooms appear

1/ Allow sufficient time for plant recovery after last cutting before first frost date. Generally, this will be 35 - 45 days for warm season grasses.

2/ Cutting times for OPTIMUM quantity and quality. It is important to understand the relationship between forage quality and quantity when managing forage for hay production. There are several factors that can influence both quality and quantity. One of the most important factors is plant maturity or stage of growth (Figure 1). Plants that are young, leafy, and in a vegetative stage are of higher quality than when the plants are in a more stemmy, reproductive stage. The reason is that there are more leaves at this stage, and leaves contain more protein and fewer fibers than the stems. Stems are more prominent in the mature, reproductive stages. Therefore, earlier cuttings will result in the higher quality hay although quantity may not be at its highest. Harvest can be delayed in order for yields to be increased, but quality will then be sacrificed. Lower quality forage is still appropriate for some classes of livestock. A forage test is the most reliable method to determine forage quality and insure that the nutritional needs of the animal being fed are met.

3/ Some forage crops, especially native grasses, may not achieve needed regrowth except under irrigation and fertility. The last cutting for all perennial species should allow 30 - 45 days recovery prior to dormancy.

4/ Do not harvest June - August.

Table 2. Moisture Content for Silage/Hay Crops

Crop	Moisture Percent Range
Green Chop	70 - 85
Silage	60 - 70
Hay	10 - 20

Figure 1.